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Retention-Tank Systems: A Unique Operating Practice for Managing Complex Waste Streams at Research and Development Facilities

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Abstract

The importance of preventing the introduction of prohibited contaminants to the sanitary sewer is critical to the management of large federal facilities such as the Lawrence Livermore National Laboratory (LLNL). LLNL operates 45 retention-tank systems to control wastewater discharges and to maintain continued compliance with environmental regulations. LLNL's unique internal operational practices successfully keep prohibited contaminants out of the sanitary waste stream and maintain compliance with federal, state, and local regulations, as well as determining appropriate wastewater-disposal options. Components of the system include sampling and analysis of the waste stream, evaluation of the data, discharge approval, and final disposition of the waste stream.

Introduction

Lawrence Livermore National Laboratory (LLNL), which is located 80 km (50 mi) east of San Francisco in the City of Livermore, is operated by the University of California for the U.S. Department of Energy (DOE). LLNL's mission is to be a national scientific, technical, and engineering resource, with a special focus on national security. This mission defines the wide range of wastewater constituents that could potentially be discharged to the sanitary sewer—for example, radioisotopes, metal-finishing rinses, semiconductor rinses, photoprocessing wastes, laser dyes, lubrication oils, and biohazards. The 10,000-person work force contributes both sanitary effluent and industrial wastewater. Therefore, wastewater management at LLNL is both challenging and diverse.

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LLNL has chosen not to have its own sewage treatment plant; therefore, all wastewater is discharged to the Publicly Owned Treatment Works (POTW) owned by the City of Livermore. LLNL is the POTW's largest industrial discharger, contributing about 6–10% of its total influent (i.e., about 1.1 ML / day).

To ensure that its discharges comply with applicable permits and regulations and that the POTW is protected, LLNL has developed a three-part wastewater-management program. These separate but related programs include a retention-tank program, a compliance-monitoring program, and an on-line, continuous-monitoring program. The retention-tank program—specifically, the Retention System Disposition Record (RSDR) process—will be the focus of this paper. Details about the compliance-monitoring and on-line continuous monitoring programs can be found in *Environmental Monitoring Plan* (Tate *et al.* 1995).

Retention-Tank Program and Retention-System Disposition Record

The retention-tank program manages wastewater upstream from the compliance and on-line monitoring programs. The RSDR process, which is an integral part of the retention-tank program, is a unique control mechanism that LLNL uses to ensure compliance and to protect the POTW. It was established in 1989 and is documented in various procedures and in *Guidelines for Discharges to the Sanitary-Sewer System* (Grandfield 1989).

Retention-tank systems are used at facilities generating large volumes of wastewater that is known, suspected, or has a potential to exceed applicable discharge limits. Once contained, this wastewater is sampled and analyzed to determine the appropriate disposition. LLNL has 45 retention-tank systems, having an average volume of 6,400 L (1,700 gal) and including tanks for hazardous, nonhazardous, radioactive, and mixed waste. The RSDR process authorizes and documents discharges from these tanks and eventually documents the waste's final disposition. The RSDR process is also used for all significant industrial discharges to the sanitary sewer.

The RSDR is a numbered, four-part form that records the sampling date, location, tank number, volume, discharge authorization, and final disposition of the waste. It essentially becomes a "permission slip" for discharges. Once the form has been completed, the data are entered into a customized CA-OpenIngres database, and the hardcopy is filed for 5 years. The database is used for generating reports to regulatory agencies, for demonstrating a history of permit compliance, for identifying status changes (sewerable to nonsewerable), for evaluating waste streams, for tracking tank closure and upgrade projects, and for developing guidance for discharges, sampling requirements, budgeting, etc.

The RSDR process also involves interaction with tank operators and with LLNL's Hazardous Waste Management (HWM) Division. HWM gets involved with the waste handling in a variety of ways. If the facility has a direct connection to the sanitary sewer, the operator or an HWM technician can discharge the contents upon receiving the RSDR approving the discharge. If the retention tank's contents exceed our internal discharge limits and cannot be discharged to the sewer, HWM may be able to treat the waste and, after re-analysis and authorization, discharge it to the sewer. Alternatively, HWM may decide to ship the waste offsite. If a facility lacks a sewer connection, the wastewater is shipped to HWM where it is discharged, once an RSDR is completed. Many operators have a full-service HWM technician who handles all their wastes, including tank sampling and discharge or pump out, as appropriate. To ensure representative sampling and proper handling of the sample by a trained person, the HWM sampling team may be called in when a tank's contents need sampling, even if there is no other handling needed by HWM.

Internal discharge limits established by LLNL are key elements in the RSDR process. These limits are based on review of the sanitary sewer system's pollutant loadings and allow for discharge of constituents from retention tanks at levels significantly above our permit limits, while maintaining permit compliance. The internal limits are, in general, about five times higher than the permit limits. For example, the permit limits for silver and mercury are 0.20 and 0.01 mg/L, respectively, versus the internal limits of 1.0 and 0.05 mg/L, respectively, for noncategorical wastes. The higher internal limits provide several advantages: (a) They allow us to discharge more process wastewater and still be confident that we will not exceed our permit limits; (b) They help the Water Guidance and Monitoring Group (WGMG) provide guidance for other (non-tank) discharges and give HWM levels to treat to in order to render a formerly non-sewerable waste sewerable; and (c) They allow us to minimize the amount of nonhazardous waste that must be handled by HWM.

The RSDR process (see Fig. 1) starts with the sampling of a retention tank. The samples are sent to our on-site analytical lab, and each sample is assigned a unique number. The on-site lab sends the results of the sample analysis to WGMG, where personnel check the data package to verify compliance with the Retention Tank Analysis List (RTAL), which is updated quarterly. The data package may include analytical results for radioactive and nonradioactive constituents. Any discrepancies are resolved here before proceeding. If there are no discrepancies, the results are compared to the internal discharge limits.

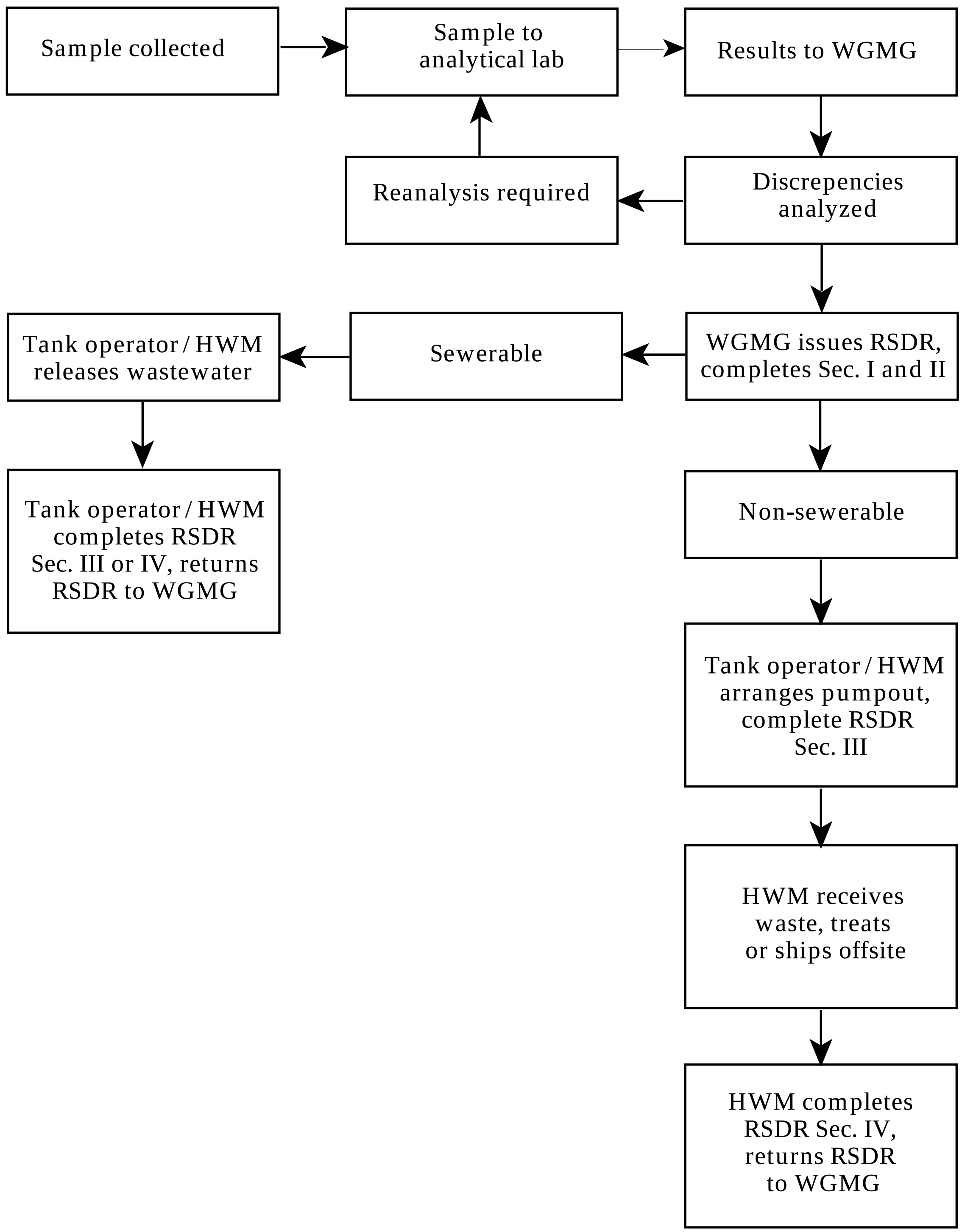

Figure 1. Abbreviated Retention Tank Release Procedure (Modified from Grandfield 1989).

The RSDR form is then initiated by WGMG personnel, who complete Sections I and II. These sections describe the waste and the tank system and document whether the discharge is authorized. A discharge may be approved with no conditions, approved with a pH adjustment, approved with conditions on flow or time of discharge, or NOT approved. The bottom copy of the RSDR is then removed, attached to the original sample data, and retained by WGMG. The remaining parts of the RSDR are attached to a photocopy of the data and forwarded to the appropriate person (usually to HWM Operations Control Group personnel). If the wastewater is not sewerable, HWM arranges for pumpout to portable tanks that are then either transported to the HWM facility for treatment and subsequent discharge or shipped offsite. Wastewater that is treated onsite is resampled before discharge, and a new RSDR is generated.

The remaining sections of the RSDR are completed and signed as appropriate. Section III, which documents the date and time of release to sewer at the facility or the transfer of tank contents by personnel other than HWM, is completed by the person responsible for the operation of the retention tank. The final section (Section IV), which documents the transfer of tank contents from the facility to HWM or the date and time of release to sewer at HWM, is completed by HWM.

Once all the appropriate sections have been completed, the top copy of the RSDR is returned to WGMG for reconciliation with their copy and for entry into the database. The RSDR package (the RSDR form plus analytical data) is filed by year and building number and kept for 5 years.

Conclusions

We believe that LLNL's RSDR process, or parts of the process, could be adapted for use by others to reduce the risk of violations and reduce the costs of hazardous-waste disposal. Our experience has been positive: since inception of the RSDR process, LLNL has not received a Notice of Violation (NOV) prompted by a retention-tank release; and the cost of sending the contents of a 18,925-L (5000-gal) tank to the sewer is about $0.08, compared to $7,500 for on-site treatment or $10,000 for off-site disposal. Also, although the RSDR was initially developed for retention-tank discharges, its flexible design allows its use for other discharges that might require documentation (e.g., slug discharges).

However, there are drawbacks, primarily related to analytical turnaround time, which may be 3 weeks or more (depending on the analyses required). Rush analyses double the cost but only marginally shorten turnaround time. Careful selection of appropriate analyses can minimize both cost and turnaround time.

The RSDR process continues to evolve. We are updating our guidance (Grandfield 1989) and our internal discharge limits to accommodate changes in operations and anticipated regulatory changes. To improve efficiency, we are automating more of the RSDR process: an electronic logbook has been developed, and our Data Management Group is developing a page on the Internet to electronically streamline particular aspects of the process.

References

Tate, P. S., *et al.* (1995), *Environmental Monitoring Plan*, Lawrence Livermore National Laboratory, Livermore, CA (UCRL-ID-106132 Rev. 1).

Grandfield, C. H. (1989), *Guidelines for Discharges to the Sanitary-Sewer System*, Lawrence Livermore National Laboratory, Livermore, CA (UCAR-10235).

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